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XII, No. 2
1961

CALIFORNIA JOURNAL OF EDUCATIONAL RESEARCH

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IN THIS ISSUE:

- Over- and Under-Achievers in Junior High School
- Teaching Machine Applied to Learning Statistics
- A Simple Method of Predicting School Enrollment
- An Analysis of Graduates' High School Experience
- Second Year Evaluation of Ability Grouping Program
- Effects of Leisure Time Activities on Achievement

published by
CALIFORNIA TEACHERS ASSOCIATION
1705 Murchison Drive Burlingame California

CALIFORNIA JOURNAL OF EDUCATIONAL RESEARCH

Published by the CALIFORNIA TEACHERS ASSOCIATION for the CALIFORNIA ADVISORY COUNCIL ON EDUCATIONAL RESEARCH

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Published at Burlingame five times a year: January, March, May, September, and November. Subscription price: $6.00 per year; single copies, $1.50. All correspondence should be directed to: CALIFORNIA JOURNAL OF EDUCATIONAL RESEARCH, 1705 Murchison Drive, Burlingame, California. Checks should be made payable to the CALIFORNIA TEACHERS ASSOCIATION.

Certain articles in this *Journal* are listed in Psychological Abstracts.

Member of the Educational Press Association of America

Entered as second class matter at the Post Office at Burlingame, California

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CALIFORNIA JOURNAL OF EDUCATIONAL RESEARCH

Volume XII MARCH 1961 Number 2

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THE EDITORS SAY:

The Conscious and the Unconscious in Research

J. R. Shannon

Any scholar with extensive experience in conducting research can testify—especially if he is inclined to be introspective—that not all of his most fertile ideas occur to him when he is seeking most diligently and consciously to generate them. Not all of his most brilliant intellectual nuggets come to his mind as immediate results of his conscious volition. Research is a creative process, and not all creativeness is subject to control by the will. Fortunately, scholars have unconscious aids working ceaselessly and untiringly toward the consummation of their research projects.

The steps in research procedure can be outlined according to different patterns. One good analysis suggests six steps: 1) recognizing and selecting the problem; 2) planning procedure; 3) gathering data; 4) treating the data; 5) drawing conclusions; 6) writing the report. Steps 3 and 4 in this outline are wholly conscious, somewhat routine, and the techniques of conducting them can be taught in formal academic courses. The first two and the last two, however, are not so easily subject to conscious control and formal instruction. It is in these four steps of research procedure that unconscious creativeness comes most into play.

Recognizing this fact, Francis Bacon, some three and one-half centuries ago, advised: *"A man would do well to carry a pencil in his pocket and write down the thoughts of the moment; those that come unsought-for are commonly the most valuable, and should be sacred, because they seldom return."* Dr. Otto Loewi stated in an autobiographical sketch, in the autumn of 1960, that the inspiration for his Nobel Prize winning research on transmission of the nervous impulse started accreting in his subconscious mind as long as 17 years before he did his experiments, and was restimulated five and two years before. Sir Walter Scott, between the times of Bacon and Loewi, said that inspiration did not come by the calendar. And Mark Twain said that books write themselves, but that the author must get started right. When the writer's "tank runs dry," said Clemens, pigeonhole it for a couple

(Continued on page 79)

Dr. Shannon, Emeritus Professor, Indiana State Teachers College, Terre Haute, Indiana, is well known through his extensive writing in the field of education. After serving as teacher, principal, superintendent, director of research, and college teacher in the mid-west, Dr. Shannon became the Coordinator of Graduate Studies at Sacramento State College (1948-52).

Over-Achievers and Under-Achievers In the Junior High School

HAROLD D. CARTER

This paper presents the results of correlation analysis involving intelligence, achievement, and personality tests administered to students in grades seven and eight. The main concern is with characteristics of pupils whose achievement test scores are higher, or lower, than one might expect in view of their scores on group tests of intelligence.

For purposes of this study, "over-achievers" have been identified as those whose achievement as measured by standard tests is higher than predicted on the basis of I.Q.; "under-achievers" are defined as those whose achievement so measured is lower than predicted on the basis of I.Q. As a further delimitation, the study dealt with only those whose actual achievement has deviated from the level predicted by an amount at least equal to the standard error of estimate.

In order to study certain personality traits and habits of over-achievers and under-achievers, the *California Study Methods Survey* has been employed. This is a standardized inventory (4), published by the California Test Bureau. Previous research (1, 3, 5) shows that it predicts school achievement very well, on the basis of attitudes and techniques of study. The inventory has been revised in order to make it more suitable for the junior high school, especially grades seven and eight. Further discussion of it will be offered in presenting some of the tabular results from this research.

Procedure Followed

The Stanford Achievement Tests and the Henmon-Nelson Intelligence Tests were administered to the students in a junior high school by the school authorities, as part of the regular testing program. Reading and arithmetic

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Harold D. Carter is Professor of Education at the University of California, Berkeley, where he has taught since 1937. Dr. Carter, who obtained his Ph.D. degree from the University of Minnesota, presented the above paper at the 39th Annual Meeting of the California Educational Research Association, at Palo Alto, California, on March 4, 1961.

scores were added together in order to provide a general measure of level of academic achievement.

At the request of the writer, the school authorities cooperated in the administration of a modified form of the *California Study Methods Survey.* The test was revised by eliminating words considered difficult by seventh graders, by eliminating items which seemed ill-fitted to the curriculum, and by introducing new items based upon essays written by students in grades seven and eight. This test provides four scores: the first is a measure of attitude toward school, seemingly indicative of self-confidence, morale, and degree of intellectual curiosity; the second is a measure of the degree to which the pupil makes use of effective techniques of study; the third is a measure of the tendency to be planful and systematic about getting school work done; and the fourth is a general indication of the over-all excellence of the pupil's study habits. All of these measures have been more fully discussed in earlier reports (3, 4, 5).

Although a larger number of students were included in the survey, it is necessary to limit this report to consideration of data from a sample of 725 students in grades seven and eight. This sample includes all the students in those two grades for whom records were complete.

Over-achievers and under-achievers, as defined in this study by means of regression analysis, can be found at all intelligence levels. Actually, the I.Q.'s of the over-achievers and the under-achievers, in pairs matched for intelligence, varied from 79 to 136. The matching was done so that in each pair the I.Q.'s did not differ by more than four points; very rarely did they differ by more than three points. An additional requirement was that the mean I.Q.'s were exactly the same for over-achievers and under-achievers. Only after the groups had been matched were the groups and pairs studied with respect to scores on the *California Study Methods Survey.*

The basic question, then, is this: do these over-achievers and under-achievers differ systematically with respect to study methods as measured by the test?

Results of Study

A sample of some descriptive results of correlation analysis, based upon data from 190 girls in grade eight, is presented in Table I. It can be seen that the correlation of achievement (as measured) with intelligence is very high. The *Study Methods Survey* is also a significant predictor of achievement. Correlations of the *Study Methods Survey* with the intelligence test are somewhat lower, and each predictor makes an independent contribution to the prediction of achievement.

However, it is perfectly clear that the correlations of achievement with intelligence are very high. This result indicates the tremendous overlap of

TABLE I

Correlations of Achievement Test Scores with Intelligence and with Scores on the California Study Methods Survey as Revised for Use in Junior High School

Scores from the California Study Methods Survey:	*r with IQ*	*r with Ach't*
1. At (Attitude toward school)	.32	.48
2. Me (Mechanics of study)	.44	.60
3. Pl (Planning and system)	.25	.37
4. TOTAL SCORE	.41	.58
Henmon-Nelson IQ		.82
Partial r of achievement test score with IQ, holding Study Survey total score constant		.78
Partial r of Study Survey total score with achievement, holding IQ constant		.47
Multiple R of achievement with combined IQ and Study Survey total score		.86

N = 190 Girls in Grade 8.

TABLE II

Correlations of Achievement Test Scores with IQ, for several Junior High School Groups

	r
190 girls in grade eight	.82
149 boys in grade eight	.84
213 girls in grade seven	.81
173 boys in grade seven	.81

group tests of intelligence and of achievement. Comparison of these findings with those from earlier studies (1, 3, 5) shows that the correlations with intelligence are lower at higher grade levels, and also when achievement is measured by grade-point averages.

Some additional correlations are presented in Table II. Here the correlations of achievement with I.Q. are about equally high in all groups. Nevertheless, these results leave room for the use of other predictors. One may note that the correlations have to be as high as .866 in order to reduce

the standard error of estimate to a level below 50 per cent of the standard deviation for the sample.

Using the correlations shown in Table II, and the appropriate means and standard deviations, regression equations were used to predict the achievement of each individual pupil. The actual achievement score was subtracted from the predicted score in order to find over- and under-achievers. The two sexes and the two grade groups were dealt with separately. After the over- and under-achievers were identified, it was possible to match about 20 pairs for I.Q. in each grade and sex group. Actually, 83 such matched pairs were included in the sample studied.

Table III presents the data for ten such matched pairs. In most instances, the over-achievers have higher scores on the study methods survey. In a few cases, the situation is reversed, as in Pair 5, where the over-achiever has unusually low scores, and in Pair 7, where an under-achiever has scores which are unusually high for a low achiever. Where the scores are higher for over-achievers, the differences are often very large; where the scores are higher for under-achievers, the differences are usually small. The trend is obvious, especially when one looks over a large number of cases. However, as a method of summarizing the findings descriptively, t-tests have been carried out, with results as shown in Table IV. It is clear that the differences are statistically significant at better than the 1 per cent level of confidence.

Discussion and Interpretation

This study tests the hypothesis that differences in study techniques, in habits and attitudes, are associated with over- and under-achievement. The treatment of data undertaken here is naturally the most severe test of that hypothesis, since intelligence is very similar to the general factor in school achievement. Theoretically, of course, greater differences may be discovered when special aspects of achievement are investigated one at a time. The special factors in achievement are likely to show more independence of intelligence, more significant relationships with other predictors.

Interesting trends with grade levels are expected when a wider range of grade levels is included. Here, in the light of previous studies (1, 2, 3, 5), it is expected that the correlation of the non-intellective factors with achievement will increase with age and grade level; will increase as we go from middle class samplings to more privileged groups; and may increase for lower-class samplings as compared with middle-class groups. On the other hand, the correlations of achievement with I.Q. may show trends in the opposite direction.

It is probable that the findings of the study would be significantly different if grade-point averages were used instead of standardized test scores as measures of school achievement. The grade-point averages are known to

TABLE III

Sample of Data, Showing California Study Methods Survey Scores for Over- and Under-Achievers, Matched for IQ

Matched Pairs	*IQ*	*Ach't Dev.*	*California Study Methods Survey Scores*			
			At	*Me*	*Pl*	*Total*
1. Over	79	2.4	34	27	17	78
Under	81	-2.1	35	23	14	72
2. Over	82	3.3	37	28	18	83
Under	81	-2.3	23	26	14	63
3. Over	88	3.3	38	34	18	90
Under	89	-2.7	29	29	16	74
4. Over	96	2.9	39	36	18	93
Under	94	-2.3	33	26	12	71
5. Over	99	2.1	27	24	11	62
Under	96	-3.1	37	24	16	77
6. Over	107	2.2	41	30	16	87
Under	108	-2.8	29	25	15	69
7. Over	114	2.0	34	30	16	80
Under	114	-3.2	39	28	19	86
8. Over	122	2.2	34	31	21	86
Under	121	-1.9	28	23	16	67
9. Over	126	2.1	40	35	17	92
Under	125	-4.5	38	27	16	81
10. Over	136	2.3	34	27	14	75
Under	136	-2.6	35	29	14	78
Maximum score possible			60	60	30	150

TABLE IV

Differences in Mean Scores on the California Study Methods Survey, for "Over-Achievers" and "Under-Achievers"

Mean Score	*Scores, California Study Methods Survey*			
	At	*Me*	*Pl*	*Total*
83 "Over-achievers"	34.38	29.22	16.34	79.83
83 "Under-achievers"	31.01	24.55	14.41	70.07
Difference	3.37	4.67	1.93	9.76
Standard Error of mean difference	.66	.62	.47	1.40
t-ratio	5.11	7.48	4.11	6.51

N = 83 Pairs Matched for I.Q.

be reliable measures of achievement, but they do not show the spuriously high correlations with intelligence test scores which are seen here. The fact is that the measures of reading and arithmetic used in intelligence tests are very similar to those used in achievement tests. It is not surprising that they are correlated. What *is* surprising is that the differences shown here between I.Q.'s and achievement test scores are by no means random.

The above comments are, of course, speculative and interpretive. They are not conclusions from the study. They are tentative generalizations based upon knowledge of a great deal of research not included here, but included in the large body of literature of which we are all more or less aware.

Summary and Conclusions

Following are some of the conclusions which may be drawn from the data which have been presented:

1. As compared with under-achievers, the over-achievers show significantly higher scores on the At scale of the *California Study Methods Survey.* This means that the over-achievers are happier in school, that they have more self-confidence, and better morale. It also means that the over-achievers have more intellectual curiosity.

2. Since the over-achievers show significantly higher scores on the Me scale of the *Study Methods Survey,* we may conclude that they have better habits of study. They tend to make more use of the study techniques which are associated with superior scholarship.

3. Since the over-achievers have significantly higher scores on the Pl scale from the study inventory, one may conclude that they are more planful and systematic about getting their school work done.

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Nonhomeostatic Experiences as Stimuli Of Children with High Curiosity

WALLACE H. MAW AND ETHEL W. MAW

Curiosity has been considered a drive whose satisfaction acts as a feedback causing the drive to be increased rather than to be reduced (1:181). Thus, the very effort of the organism in the environment to reach homeostasis seems to lead to a new nonhomeostatic relationship. Taylor (4) defined curiosity as the organism's effort to come to terms with an environment that is disturbing to it. Menaker (3), after a study of pre-school children, reported that the child was first afraid of the new situation, then approached the fear object, and only then became curious about it. Emch's (2) psychoanalytical study of the effects of the Unknown on adjustment indicated that some people are more desirous of moving into the Unknown than are others. From these studies it might be concluded that children with a high degree of curiosity are those who willingly move out from a familiar and secure position and seek to establish contact with aspects of the environment that present novelty or some disequilibrium. Conversely, it might be concluded that children lacking in curiosity tend to seek more balanced environments and show little or no desire to encompass an ever-growing world into their life spaces. Therefore, it was hypothesized that children with high curiosity would voluntarily select experiences related to an unbalanced or unfamiliar environment more frequently than would children of low curiosity.

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Ethel W. Maw is lecturer in education at Bryn Mawr College, Pennsylvania, a position she has held for four years. She was formerly an elementary teacher, a teacher at the University of Pennsylvania reading clinic, and was also a Fulbright lecturer at the University of Delhi in the same year as her husband. She obtained her Ph.D. in 1959 from the University of Pennsylvania.

The article is one of a series based on data obtained from a project conducted under a grant from the U. S. Office of Education, Department of Health, Education and Welfare.

In order to test the hypothesis, the following steps were taken:

1. Children with high curiosity and children with low curiosity were identified.

2. An instrument to measure the desire of the children to seek experiences with unbalanced or novel stimuli was designed.

3. The instrument was administered to children of high and low curiosity and the differences between the scores of the two groups were studied.

The identification of children with high and low curiosity. The identification of children with high and low curiosity is described in detail elsewhere.[1] Briefly, the procedure was as follows:

1. Philosophical and theoretical statements regarding curiosity and investigations of the exploratory behavior of animals, primarily subhuman, were analyzed.

2. An operational definition was obtained on the basis of the analysis. In the definition, an elementary school child was said to exhibit curiosity to the degree that he:

   a. reacts positively to new, strange, incongruous, or mysterious elements in the environment by moving toward them, by exploring them, or by manipulating them,

   b. exhibits a need or a desire to know about himself and/or his environment,

   c. scans his surroundings seeking new experiences, and

   d. persists in examining and exploring stimuli in order to know more about them.

3. The teachers and pupils of five fifth-grade classes were asked to select the children in their classroom who exhibited a high degree of curiosity and those who showed a low degree. The selection was found not to be affected by age, race, popularity, or sex. The effect of intelligence was statistically controlled.

4. The 15 pupils of the high-curiosity group and the 20 pupils of the low-curiosity group thus identified among the 158 children in the five classrooms were asked to judge themselves as to the degree of their curiosity. The difference between the means of the two groups was in favor of the high-curiosity group and was highly significant.

Table I shows the means and standard deviations for the high and low curiosity groups of age in months, of popularity scores on the *Ohio Social Acceptance Scale*, and of Lorge-Thorndike intelligence quotients.

The groups were not significantly different in age, popularity, or intelligence. The close similarity in intelligence was to be expected because of statistical control of that variable.

[1] A report describing the analysis and giving complete data in tables has been deposited with the American Documentation Institute.

TABLE I

Mean and Standard Deviation of Age in Months, of Popularity Scores, and of Intelligence Quotients of Pupils in High- and Low-Curiosity Groups; Significance of Difference Between Means and Variabilities

		Age		*Popularity*[a]		*Intelligence*	
Curiosity Group	*N*	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*
High	15	130.33	6.90	93.50	22.87	105.07	16.76
Low	20	128.30	6.21	104.90	21.19	105.60	16.70
		t=.91	F=1.26	t=1.47	F=1.19	t=.09	F=1.03
Level of Significance		P>.30	P>.20	P>.10	P>.20	P>.90	P>.20

[a] A low score indicates high social acceptance.

The development of an instrument to measure acceptance of the unbalanced and unfamiliar. An instrument to measure children's acceptance of the unbalanced and unfamiliar was developed. It was a paper-and-pencil test consisting of twenty pairs of geometric figures and symbols. In each pair, one was more balanced and/or more familiar than the other. The test, entitled "Which-to-Discuss," can be administered to an ordinary class in less than 30 minutes and scored in less than one hour. In scoring, the unbalanced or unfamiliar was scored one; the balanced or familiar was given no credit.[2]

The test was administered to 187 fifth-grade children in six classrooms of the public schools of New Castle, Delaware. For the total group, the mean of the ages in months was 129.7 and the standard deviation was 6.6. The mean and standard deviation of the Lorge-Thorndike intelligence quotients for the same group were 103.8 and 15.7 respectively. The group was considered to be representative of fifth-grade children of similar suburban communities.

The coefficient of internal consistency based upon the scores of the 187 fifth-grade pupils and calculated by the Kuder-Richardson formula for estimating reliability was .91. The items of the test were of approximately equal difficulty for these children. The distribution of scores was bimodal.

The instrument was administered to the 15 children identified as having high curiosity and to 18 of those identified as having low curiosity. Two children of the latter group were not available for testing when the "Which-to-Discuss" test was administered.

[2]For further information or for copies of the test, contact the authors.

Results and Discussion

Table II shows the means and standard deviations of scores on the "Which-to-Discuss" test of pupils of the high- and low-curiosity groups. The difference between the variabilities of the two groups was not significant at the .05 level when tested by the F ratio. As was predicted, the high-curiosity group excelled significantly. The means were 15.60 and 9.22 for the high- and low-curiosity groups, respectively. For the *t* test of the difference between the means, *t* was 3.22, and the corresponding P was .005. Since there is no satisfactory test for normality in small groups, it was thought best to check these results with a nonparametric test. Therefore, the difference between the groups was tested by the Mann-Whitney U test and was found to be significant at the .016 level. When the items of the test were studied, every item was found to discriminate in favor of the high-curiosity group. The hypothesis that children of high curiosity select unbalanced and unfamiliar stimuli more frequently than do children of low-curiosity was supported by the evidence.

TABLE II

Number, Mean and Standard Deviation of Scores on the Which-to-Discuss Test of Pupils in High- and Low-Curiosity Groups; Significance of Difference Between Means and Variabilities

Curiosity Group	*N*	*Mean*	*Standard Deviation*
High	15	15.60	4.08
Low	18	9.22	6.41
		U=73.5	F=2.44
Level of Significance		P<.02	P>.10

* The Mann-Whitney U Test was used.

The findings of the study raised some interesting questions. The "Which-to-Discuss" test separated the fifth-grade children into two distinct groups, those who chose the balanced and familiar and those who chose the unbalanced and unfamiliar. What other differences can be found between these two groups? Do they differ in energy, in intelligence, in personality structure? Do the parents of the children differ in child-rearing practices, in liberalism or conservatism of outlook? Further study will be made to find the answers to these questions.

Questions regarding teaching methods and classroom practices also come to mind. Teachers often promote learning by disturbing the environmental

balance of the pupils. Although little learning can be expected to take place unless the child is disturbed, the degree of disturbance that is most effective varies from child to child. For some children a disturbance or imbalance of any kind can easily become overwhelming. When this happens, the child will retreat in any of a variety of ways and will not seek further experiences with the disturbing object, topic, or situation. The "Which-to-Discuss" test may prove useful in identifying children who can tolerate varying degrees of disturbance or imbalance. Careful study and observation of the children thus identified may help explain the differences and may help teachers to determine the optimum pacing of learning tasks for each child.

The fact that two groups of children very similar in I.Q. scores were significantly different in their performance on the "Which-to-Discuss" test lends support to the argument for individualized instruction. It indicates that children with identical scores on I.Q. tests may vary widely in the kinds of challenges they will accept.

Summary

It was hypothesized that children of high curiosity select experiences related to an unbalanced and/or unfamiliar environment more frequently than do children of low curiosity. Two groups of fifth-grade children, one showing high curiosity and the other low, were selected by the combined judgments of teachers and peers. The two groups differed significantly in self-judgment of curiosity.

A nonverbal test consisting of pairs of geometric figures and symbols was constructed to measure the extent to which children select the unbalanced and unfamiliar in preference to the balanced and familiar. When the scores of the high- and low-curiosity groups were compared, it was found that the children of the high-curiosity group had chosen the unbalanced and unfamiliar significantly more often than had the children of the low-curiosity group.

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An Evaluation of the Second Year Of An Ability Grouping Program

WILLIAM G. SAVARD

This report summarizes the empirical evaluation of the second year of an experimental program of ability grouping in grades four through eight in the Burlingame (California) School District. The evaluation of the first year of the program has been reported previously.[1] The program is called "limited-range grouping" because it limits the range of ability found in any one classroom. A limited-range class consists of average pupils plus a small number of either above-average or below-average pupils. Classes are called "upper-range" or "lower-range."

Limited-range grouping was adopted because it seemed to be a reasonable compromise between highly "homogeneous" grouping and the extremely wide span of abilities found in typical heterogeneous classes. It was not expected that limited-range grouping would solve all of the problems of the classroom teacher. The modest hope was that it would provide the teacher with a more manageable teaching situation by removing the extremes in the span of achievement and ability that do exist in a typical class while maintaining the presumed advantages that are claimed for heterogeniety.

In grades 4, 5 and 6, limited-range classes were established on the primary criterion of the average reading score from previous Stanford Achievement Tests. In grades 7 and 8, where classes are departmentalized for mathematics and English, groups were formed on the basis of both average reading and average arithmetic scores of previous Stanford Achievement Tests. Thus, it was possible for a child with differential reading and arithmetic ability to belong to two separate groups; one upper-range, the

[1]William G. Savard, "An Evaluation of an Ability Grouping Program," *California Journal of Educational Research*, 11:56-60, March 1960.

William G. Savard is currently director of personnel training and development, Department of Public Instruction, State of Hawaii. He was formerly director of educational guidance in the Burlingame, California, School District, at which time he conducted the research described in the article. Dr. Savard obtained his doctor of education degree from Stanford University in 1960.

other lower-range. Secondary criteria used were intelligence test scores, report card grades, and other information in the cumulative record folders. The class range on the primary criterion was held to between two and three years. Overlap in range between classes of the same grade was from two to three years.

Purpose of the Study

The purpose of the study was to assess the effects of limited-range grouping on growth in reading and arithmetic, as measured by the Stanford Achievement Test. While the general expectations for limited-range grouping went beyond these two skill areas, the present report is limited to them. The specific sub-tests used were Paragraph Meaning, Word Meaning, Arithmetic Reasoning, and Arithmetic Computation.

The following questions were posed for inquiry:

1. How do gains made by pupils in limited-range classes compare with gains made by the same subjects under heterogeneous class groupings?

2. Is there any relationship between intelligence and the effects of limited-range grouping?

Study Design

Mean gains made by groups of pupils during the school year 1959-60 (under limited-range grouping) were compared with gains made by the same subjects during the school year 1957-58 (under heterogeneous grouping). The mean differences in gains were tested for significance by the method of the "t" test for means of differences between correlated measures.[2] Two-tailed probabilities were determined because losses as well as gains had been found in the previous year's evaluation.

Grade placement scores (which are not equal units) were converted into K scale scores[3] of the Stanford Achievement Test, in order to provide comparable units of growth at different grade levels.

The sample consisted of the survivors of the sample used in the first year's evaluation. Of the 156 subjects in the first year's sample, 44 had graduated, 12 had moved out of the district, and 3 were absent during the

[2]Quinn McNear. *Psychological Statistics.* Wiley and Sons, New York, 2nd Ed., pp. 108-9.

[3]Eric F. Gardiner. "The Determination of Units of Measurement Which Are Consistent with Inter and Intra Grade Differences in Ability," *Harvard Educational Review,* 19:2:123-24, Spring 1949.

testing period. Of the 97 survivors, 45 were in upper-range classes for the second consecutive year, 38 were in lower-range classes for the second consecutive year, 10 were in upper-range classes after having been transferred there from lower-range classes at the end of the first year of the program, and 5 were in lower-range classes, having been transferred there from upper-range classes. The sample was determined to be approximately normal in regard to distribution of intelligence test scores. It is assumed that the teachers of the sample met the same criteria for selection as did the teachers involved in the first year's evaluation, i.e., had taught the same grade the previous year, were committed to the limited-range program, had definite programs for helping upper- or lower-range groups, and were willing to undergo this inquiry. Table I summarizes the characteristics of the sample.

TABLE I

Frequency Distribution of Sample, by Intelligence Test Score Category, and Type of Grouping

	Intelligence Test Score Category				
	$< -1\sigma$	$\bar{X}$ *to* -1σ	$\bar{X}$ *to* $+1\sigma$	$> +1\sigma$	*Total*
Upper-range classes	1	11	19	14	45
Lower-range classes	16	13	7	1	37
Transferred at end of 1st year, lower to upper	1	4	2	3	10
Transferred at end of 1st year, upper to lower	1	1	3		5
TOTAL	19	29	31	18	97

Results

Analysis by Range of Class. Table II shows the gains made by upper- and lower-range groups, transferred pupils, and the sample as a whole. In general, the results favor limited-range grouping. The three losses shown are for transferred pupils. The losses might be explained by difficulties which caused the transfers rather than as results of transfers or grouping procedures. It might also be noted that the numbers are small. For the sample as a whole, the results strongly favor limited-range grouping; three of the four positive differences shown are significant at the .01 level. Both upper- and lower-range classes show all differences in favor of limited-range groupings, three of the eight being significant at the .01 level. Lower-range classes appear to have benefited slightly more than upper-range classes.

TABLE II

Mean Differences in Gains, in K Score Units, Made by Pupils in Limited-Range Classes, Relative to Gains by Same Pupils in Heterogeneous Classes

	Sub-Test			
	Paragraph Meaning	*Word Meaning*	*Arithmetic Reasoning*	*Arithmetic Computation*
Upper-range classes N = 45	9.24**	1.60	1.58	5.01
Lower-range classes N = 37	2.06	5.47**	2.84	13.08**
Transferred at end of 1st year, lower to upper N = 10	–3.21	6.28*	3.22	15.90**
Transferred at end of 1st year, upper to lower N = 5	4.78	–5.86	–14.16**	6.44*
Whole Sample N = 97	4.70**	3.18**	1.42	9.28**

(A positive difference favors limited-range grouping; a negative difference favors heterogeneous grouping.)

*two-tailed $p < .05$

**two-tailed $p < .01$

TABLE III

Mean Differences in Gains, in K Score Units, Made by Pupils of Various Intelligence Score Categories in Limited-Range Classes, Relative to Gains Made by Same Pupils in Heterogeneous Classes

Intelligence Test Score Category	*Sub-Test*			
	Paragraph Meaning	*Word Meaning*	*Arithmetic Reasoning*	*Arithmetic Computation*
$> +1\sigma$ N = 18	5.02	4.73	3.24	10.71**
$\bar{X}$ to $+1\sigma$ N = 31	8.30**	1.84	4.05*	2.96
$\bar{X}$ to -1σ N = 29	.85	1.86	1.44	14.04**
$< -1\sigma$ N = 19	1.67	5.31**	5.85*	10.15**

(All differences (positive) favor limited-range grouping.)

*two-tailed $p < .05$

**two-tailed $p < .01$

Analysis by Intelligence Levels. Analysis by intelligence levels shows all differences favoring limited-range grouping. Seven of the 16 differences shown in Table III are significant at either the .05 or .01 level. While limited-range grouping appears to benefit all intelligence levels, it seems to be particularly appropriate for the lowest level shown.

The results of this evaluation favor limited-range grouping more strongly than did the first year's evaluation. This is a reasonable finding in view of the fact that in the first year's evaluation it was necessary to compare 7 months of limited-range against 10 months of heterogeneous grouping, whereas this report compares like time periods. Also, the teachers had a year's experience with limited-range grouping before the second year's program began, and hence could better adapt the classroom program to fit the needs of the particular range of pupils they were dealing with.

Adaptation of the educational program to the particular needs of a class group appears to be the critical issue in a grouping program. It is suggested that limited-range grouping makes this adaptation easier by limiting the extremes of ability any one teacher must deal with. The findings that limited-range grouping is of special advantage to lower-range classes and lower intelligence levels is consistent with the findings of the first year's evaluation. This might be interpreted as indicating that teachers of lower-range classes conducted programs better suited to their pupils than did teachers of upper-range classes. However, the possibility that the Stanford Achievement Test has insufficient "ceiling" for use with upper-range pupils in grades 7 and 8 must be borne in mind.

The CTA Research Department reports the most recent publications in its Research Bulletin series . . . No. 142, *Salaries and Salary Schedules for Special Services Personnel, 1960-61*; No. 143, *Educational Research Projects Reported by County and District Offices—1959-60*; No. 144, *Class Size in California High Schools.* Soon to be released is Research Resume No. 17, *The Role of Hypotheses in Educational Research.*

Teaching Machine Theory Applied To Learning Statistics

FRANK F. GOROW

A problem confronting many college instructors is lack of time to "cover" the subject adequately. This was the case in a two-unit Tests and Measurements course for prospective secondary school teachers. The aims included proficiency in test construction, statistical analysis, and interpretation of measurement results—along with coverage of a dozen other topics about which high school teachers ought not to be ignorant.

Recent literature on the theory of "teaching machines" suggested the possibility of saving class time in teaching the statistics portion of the course. Could the statistical concepts and procedures be "programmed" into the *scrambled book* version of a teaching machine? Would the students be able to learn the computations and the meanings by merely working through the steps in a book? Would they learn as well as comparable students taught by chalk-board demonstrations and lectures? Can class time be saved by automated teaching—on the student's own time?

In an attempt to find answers, three "scrambled booklets" were prepared and tested in the writer's classes. The first booklet explained the computation of measures of central tendency and of spread for a small sample of test scores. The second expanded the same concepts and explained computations for a large sample of scores. The third booklet developed the concept of correlation and presented the deviation method of computing it.

Testing the Hypotheses

A simple experiment was devised to test the hypotheses that (1) class time could be saved by using the scrambled book version of a teaching machine, and (2) students would learn as much by this method as would other students taught by traditional procedures.

An experimental group, to whom the booklets were given, consisted of

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two sections of the course, or about 60 students. Four class periods were allocated for answering questions and for two related lectures. No computational procedures were demonstrated.

A control group included about 40 students in a third section. A total of nine class periods were required for the explanations and demonstrations of every computation which was included in the booklets (and the two related lectures). Procedures were explained as carefully as possible and repeated on request. The time, nine hours, compared with six or seven hours in previous classes which had used worksheets.

The two groups were selected by the routines of college registration: the experimental classes met at consecutive hours on Tuesdays and Thursdays; the control class met on Mondays and Wednesdays. Little information was available for comparison of groups. One prior test in the course (Teacher-Made Tests and Preparation of Test Items) favored the Control Group slightly. The correlation between scores on this test and on a test of statistics had previously been found to be low (0.34 to 0.43). CQT (College Qualifying Test) scores were available for approximately one-half of the students in each group. When PR's were converted into standard scores and compared, the difference between the means favored the Control Group (CR = 2.06). Scores on the quantitative portion were separately compared. The difference again favored the Control Group but was not significant (CR = 0.67).

The limited data suggested that the Control Group should score slightly higher than the Experimental Group on a test of computation and understanding of statistics. The amount of time and careful instruction given the Control Group, as compared with that given the Experimental Group, again appeared to favor the former.

Two tests were prepared to measure ability to quickly compute the various statistics and to measure concepts and understandings. The first test was in two parts: the mode, mid-point, range, and arithmetic average were to be obtained from 16 given test scores; and the mean, median, quartiles, quartile deviation, and standard deviation were to be computed after making a frequency distribution of 50 scores given in rank order. Fifty minutes were allowed for the entire test; notes and formulae were neither furnished nor permitted.

The second test contained two matching exercises (symbols and their meanings, and certain terms and their meanings); 36 multiple-choice items; and a set of data from which numbers must be substituted for symbols in given formulae. Again, 50 minutes were allowed for the test.

Results

As was predicted, the Control Group consistently scored slightly higher than the Experimental Group. The results on the Computation Test, with a

possible score of 50 points, are shown in Table I.

The difference between the means favors the Control Group (CR = 2.15). In comparing various percentages of a "perfect" score, the Control Group excelled in every instance.

The results on the Concepts and Understandings Test, with a possible score of 56 points, are shown in Table II.

TABLE I

Results on Computation Test

	Experimental Group	*Control Group*
Range	6 - 50	13 - 49
Mean	32.7	38.0
SD	14.0	9.2
SE_{mn}	1.82	1.58

TABLE II

Results on Concepts and Understandings Test

	Experimental Group	*Control Group*
Range	16 - 48	18 - 50
Mean	34.00	34.9
SD	7.24	6.3
SE_{mn}	0.95	1.03

The difference between the means favors the Control Group, but is not significant (CR = 0.65). In comparing "absolute achievement," the difference between the middle groups of students favored the Control Group, but the high-scoring and the low-scoring students in the Experimental Group excelled.

The frequency polygons of the test results reveal interesting and significant aspects of performance. Most notable is the bi-modal distribution of the Experimental Group on the first test (Figure 1). Nearly one-fifth of those whose instruction was obtained from the scrambled booklets "didn't get it." Did they or did they not work through all of the steps as presented? If questions arose, were the questions asked (and answered) in the class

FIGURE 1

First Test: Consumption of Statistical Measures

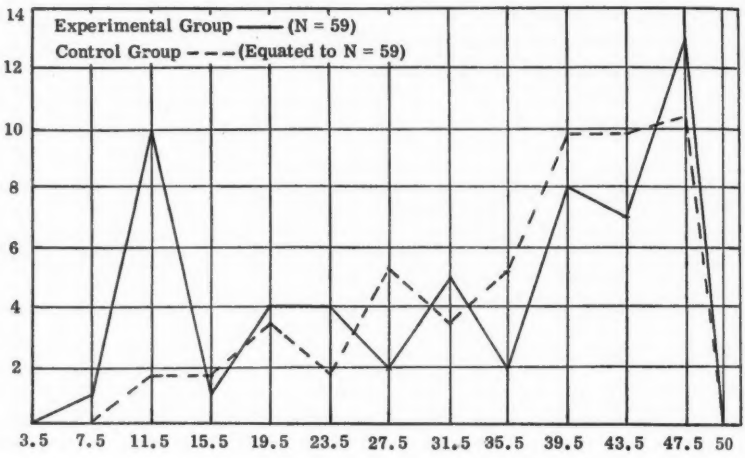
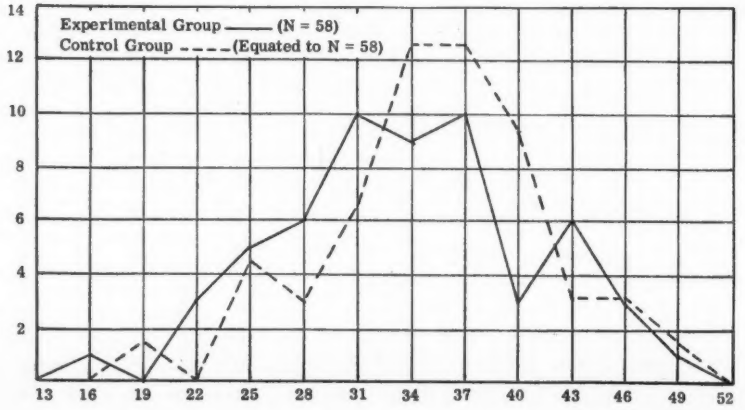


FIGURE 2

Second Test: Concepts and Understandings in Statistics



periods scheduled for this purpose? In contrast, the second mode of the same distribution is very close to a perfect score of 50. The distributions of the second test (Figure 2) are typical of multiple-choice test results and reflect the slight difference in performance of the two groups.

Learning Retention

A portion of the final examination in the course was devised to measure retention of computational procedures. This measure is contaminated, obviously, by individual preparation for a final examination, but sheds some light on end results of instruction in the course. The statistics portion included a frequency distribution (with sums) and instructions to "set up the problems but do not compute values" for seven measures. Although but a small part of the total examination, this was the only test of statistics which could conveniently be scored separately. The difference between the means of the Control Group and the Experimental Group was *less* than that of the two sections comprising the Experimental Group. Neither of the differences was significant.

Conclusions

On the basis of limited experience with a crude model of one form of "teaching machine," one may well conclude that further experimentation is warranted. The results obtained thus far clearly indicate that, for many students, the experimental procedure (using scrambled booklets) was as effective as the lecture-demonstration method of instruction in statistics. For some students, however, self-instruction was not effective for a reason, or reasons, which should be found. The most important conclusion is that class time *can* be saved by providing self-learning materials. Whether the low-scoring students can also be "saved" by improving the learning materials is the problem of the next experiment. In any event, the writer concurs with J. R. Shannon: "Research is Fun."

A Simple Method of Predicting School Enrollment

HENRY IRVING WEITZEL

While the duties of research directors in city school systems have been found to vary considerably, there is one responsibility that all are likely to share in common. That is the necessity of supplying their superintendents and boards of education with both short-range and long-range predictions of school enrollment.

Furthermore, where this is a function of a research director it is almost always one of his most important functions. The preparation of the annual budget is based on estimates of the following year's enrollment which are as exact as possible. Consequently, there must be made at least once a year detailed enrollment forecasts for each school by grade level. These may be thought of as short-range predictions.

In any growing school system there must also be available detailed predictions of school enrollment, projected as far into the future as they have real meaning, in order that the school system may plan for and keep up with its building needs. Either type of prediction may influence the spending in a single year of millions of dollars.

One of the most significant factors in the making of enrollment predictions is the experience of the past. Therefore, unless the Research Office is charged with the responsibility of collecting and certifying attendance and enrollment data for the school system, it must at least have ready access to all such data. In some systems the practice is for school principals to submit duplicate reports monthly—one to the Business Office and the other to the Research Office. The research worker will need to have official attendance and enrollment reports that go back for a period of years.

Another prime necessity is the ability to accurately forecast Kindergarten enrollment. Many school systems, especially in the East, conduct an annual school census. This can be a very valuable instrument which, among other things, usually takes care of the next fall's Kindergarten problem. However, since the school census is virtually unknown in California, the forthcoming

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Kindergarten enrollment must be obtained in some other manner.

The number of live births of children born to mothers who actually reside within a school district in any given year is obviously a clue to the number of Kindergarten pupils who may be expected to enroll approximately five years later in that district. Unfortunately, live birth data (corrected for residence) are seldom kept for such political subdivisions as school districts. When available in California, they are for municipalities only. Even more disconcerting is the fact that in Los Angeles County, for example, with its vast population, vital statistics suitable for this purpose are kept only by the municipalities of Los Angeles, Long Beach and Pasadena.

The Pasadena City (Elementary) School District presently consists of the City of Pasadena, Altadena (unincorporated), and certain other unincorporated areas to the east and south. About two-thirds of the elementary school pupils reside within the city limits. A natural question is this: "Is there any fairly constant relationship between the number of children born within the city itself in any one year and the number entering Kindergarten from the larger area (the school district) five years later?" Table I shows that there is such a relationship; and this gives us the key to the prediction of Kindergarten enrollment. To estimate the number who will enter Kindergarten in the fall of 1961, for example, we need to know only the live births in Pasadena in 1956 (corrected for residence), and the factor.

TABLE I

Relationship Between Live Births and Kindergarten Enrollment

Year	*Live Births (Corrected for Residence)*	*Year*	*Kindergarten Enrollment*	*Ratio*
1946	1,795	1951	2,107	1.174
1947	2,028	1952	1,910	.942
1948	1,944	1953	2,226	1.145
1949	1,854	1954	2,185	1.179
1950	1,769	1955	2,242	1.267
1951	1,720	1956	2,188	1.272
1952	1,920	1957	2,385	1.242
1953	2,078	1958	2,377	1.144
1954	2,074	1959	2,398	1.156
1955	1,924	1960	2,386	1.240
Average (10 years)				1.176
Average (last 3 years)				1.180

The next step is to ascertain how many entering Kindergartners will probably enroll in Grade 1 the following year, how many of those in Grade 1 will enter Grade 2 the next year, etc. Here is where the official attendance and enrollment reports of past years become invaluable. If in 1958 - 59

School A enrolled at the end of the first school month 100 Kindergartners, but at the same time in 1959-60 had only 85 in the first grade, the **survivorship ratio** would be .85 between Kindergarten and Grade 1 for that school for those years. Similarly, if School B enrolled at the end of the first school month in 1959-60 100 in the first grade, but for some reason had at the same time in 1960-61 102 in the second grade, its survivorship ratio between Grade 1 and Grade 2 would be 1.02 for the years 1959 to 1960.

In a like manner, survivorship ratios are calculated either for individual schools or for the school system as a whole between Grades 2 and 3, between Grades 3 and 4, between Grades 4 and 5, and between Grades 5 and 6. This should be done for a number of years back or, more correctly, for a number of pairs of years. Because the Pasadena City Schools do not represent a unified school district as this is written, a difficulty arises at Grade 7. At this point pupils who have completed the sixth grade in the independent elementary school districts included within the larger Pasadena City High School District enter Pasadena junior high schools. The estimation of seventh grade enrollment now becomes a problem. Shall it be based on live births in the City of Pasadena 12 years earlier in the same fashion as was done to obtain Kindergarten enrollment, or shall it be based on a "survivorship ratio" between the sixth and seventh grades, even though the seventh grade enrollment may considerably exceed the sixth?

Apparently too many things happen over a twelve-year period for the former method to remain reliable. Also, the population of the city may not be sufficiently large in comparison with that of the high school district to be representative. Experience has shown, fortunately, that the survivorship ratio method can be used to obtain the probable seventh grade enrollment with satisfactory results. Survivorship ratios for six elementary, three junior high schools and both senior high schools for the years between 1958 (October) and 1959 (October) are shown in Table II.

It will have been noted from Table II that survivorship ratios between Grades 6 and 7 were not calculated for individual junior high schools. Besides the fact that sixth-grade graduates from independent elementary school districts at this point enter our junior high schools, there is another complicating factor. This is that many of our own elementary schools are not "zoned" to a specific junior high school.

The survivorship ratio for all junior high schools taken together can be used, however, to obtain the probable total seventh-grade enrollment. The percentage of seventh-grade enrollment that each junior high school has contributed in the last three years is then calculated. Finally, the three-year average becomes the percentage of the expected total enrollment that is allocated to each junior high school as its probable number of seventh-graders in the fall.

Individual survivorship ratios between Grades 9 and 10 were calculated, on the other hand, for the two senior high schools. This is because there

TABLE II

Survivorship Ratios for Elementary, Junior High, and High Schools

Grade	SURVIVORSHIP RATIO *Elementary Schools* A	B	C	D	E	F	All (26)
Kindergarten to 1	1.048	.779	1.194	.789	1.070	.955	.943
1 to 2	1.183	.892	.912	1.000	.863	.707	.964
2 to 3	1.279	.991	.920	1.053	1.071	.934	.992
3 to 4	1.113	1.009	1.000	.870	1.033	.846	.992
4 to 5	1.033	1.018	.917	1.039	1.085	.769	1.001
5 to 6	1.125	.963	.818	.912	.988	.909	1.010

	Junior High Schools M	N	O	All (6)
6 to 7				1.232
7 to 8	1.013	.969	1.054	.998
8 to 9	1.025	.980	1.037	1.020

	Senior High Schools Y	Z	Both
9 to 10	.984	.963	.973
10 to 11	.967	.983	.975
11 to 12	.914	.940	.927

is strict zoning, at the present time at least, between the junior and senior high schools. Graduates of three specified junior high schools must attend senior high school Y, while graduates of the remaining three attend senior high school Z.

It should be emphasized that the ratios in Table II are for a single pair of years—October 1958 to October 1959. In making the enrollment forecasts for October 1960, the average of the three latest pairs of years was used; that is, 1956 to 1957, 1957 to 1958, and 1958 to 1959. Although in the past we have used five-year averages, and even, upon occasion, eight-year averages, the three-year span has been found to be very satisfactory. In fact, many times it proved superior. To keep enrollment predictions current, one has only to discard once a year the oldest of the three sets of data, calculate a new set, and obtain a new "three-year average."

Obviously, if a school has been established for less than four years, a three-year average for it will not be possible. In such cases, one uses the average of the latest pairs of years, or even the latest pair. Until an enrollment "pattern" has developed, however, such data may not be as reliable as would be desired. Again, where zoning changes have taken place either as a result of a change in policy of the governing board regarding the issuance of transfer permits, or as a result of the establishment of new schools, only survivorship ratios obtained after the new policies or the new boundary lines have become effective should be utilized.

While it is possible as mentioned earlier to predict enrollments for the

elementary schools as a whole and for all junior high schools as a group, detailed individual school information is almost certain to be desired. It is not enough merely to know that the elementary school population will increase 4 per cent in a year if one school may gain only 2 per cent while another gains 6 per cent. So, the best way to obtain totals by level is to get school totals first—school by school, grade by grade, year by year—and then to combine the data. The Kindergarten enrollment in each elementary school (which is actually the starting point) can be allocated once the following year's expected total has been determined, by calculating the percentage that each school's enrollment at that level has been of the total Kindergarten enrollment in each of the last three to five years. The average is then used.

There are two advantages in making long-range enrollment predictions on an annual basis. Obviously, actual enrollment figures will be used for the current year, which then becomes the new "base year." Also, somewhat "fresher" survivorship ratios become available. These ratios when applied to current enrollments should make the estimate for the following year quite reliable. Of course, as these ratios are applied to calculated enrollments of succeeding years, which may or may not turn out to be substantially correct, less accuracy can be expected. As most of us realize, the farther ahead one "predicts" the more hazardous the procedure becomes.

So far, nothing has been said of junior college enrollment predictions. It should be mentioned here that estimating future junior college enrollment is the most hazardous of all. In fact, there are many who feel that junior college enrollment is virtually unpredictable on a long-range basis. It may, or may not, be influenced by high and low birth-rate years. Percentage-wise at least, most public junior colleges experience extreme fluctuations in enrollment from year to year. The day enrollment in the Pasadena City Junior College District, shown in Table III, may be a case in point.

There are at least five reasons that can be cited to explain the junior college enrollment prediction difficulty, some of which are rather obvious. First, junior college enrollment is voluntary; there is no longer any "compulsory attendance." As a matter of fact, school attrition is stepped up rapidly after age 16, as the data in Table II suggest.

Second, there is the economic situation. When there are plenty of well-paying jobs open to the high school graduate, junior college attendance often suffers. Those who do attend are likely to be working on the outside. They may carry fewer units than would otherwise be the case and, even then, find that the part-time school load "interferes with the job." In case of difficulty, school, rather than the job, is what is likely to be dropped. On the other hand, an unfavorable economic situation greatly increases junior college attendance. The experience of the great depression was that youth and adults turned to, and returned to, junior colleges "in droves."

Third, there is the military situation. This may be closely related to the above. In times of international stress there is apt to be great military

TABLE III

Day Enrollment in Pasadena City Junior College District

Year	*Day Enrollment*	*Percentage Change From Previous Year*
1946-47	4320	118.7%
1947-48	4435	2.7%
1948-49	4657	5.0%
1949-50	5054	8.5%
1950-51	4260	- 15.7%
1951-52	3326	- 21.9%
1952-53	3724	12.0%
1953-54	3483	- 6.5%
1954-55	3827	9.9%
1955-56	3961	3.5%
1956-57	4126	4.2%
1957-58	4403	6.7%
1958-59	4866	10.5%
1959-60	4911	0.9%
1960-61	5561	13.2%

spending; this may mean "good times" and plenty of jobs. Then there is the military obligation which nearly all young men have. It has been observed time and again that when Selective Service calls are heavy, recruiting is correspondingly heavy in all branches of the Armed Forces. Whether they are drafted or whether they enlist, many young men who would otherwise attend junior college find themselves in military service. Feelings of uncertainty undoubtedly play a big part—trying to estimate when the Selective Service call will come, lack of assurance that he will be able to enlist in the branch of service or in the specialty of his choice, and the like. Parenthetically, the school's experience during the Korean War was that great numbers of young men could have attended junior college for one, two, or more semesters before entering military service but simply did not do so. It was difficult to convince them that this was possible without jeopardizing any military opportunity that they might have. And strangely enough, for whatever the reason, when boys in large numbers do not enroll in the junior college, girls do likewise.

A fourth difficulty of predicting junior college enrollment, at least on a long-term basis, is the possible or probable establishment of new public junior colleges which would siphon off unknown numbers of students. Under California law, high school graduates whose legal address is in a district that does not maintain junior college classes may attend any public junior college in the state. We refer to areas which are not in a junior college district (or in a high school district maintaining junior college classes) as "free territory." As might be expected, some junior college districts are much more popular among free territory students than others. The location of the homes of many of these students would permit them to attend junior

college in either of two (or perhaps in one of three) junior college districts without undue hardship. For a number of years about 35 per cent of the day enrollment at Pasadena City College has been made up of free territory students. To what extent this percentage will be reduced in future years, due to the establishment of new junior colleges, is a question to which there has been so far no satisfactory answer.

A fifth factor in making difficult the long-range prediction of junior college enrollment has to do with admission requirements. California public junior colleges are required by law to accept all high school graduates. As a result, the scholastic records of a typical entering class vary tremendously.

On the other hand, the state colleges and the public and private colleges and universities all have their own admission requirements. Two things we know. First, higher-education enrollment will more than double in the state in the next ten years. Second, admission requirements are already being tightened and will doubtless be made more severe as time goes on. How much increase does this portend for junior colleges in general? In the case of a particular junior college, will the increase be sufficient to make up the loss of more than one-third of its enrollment if new junior colleges in the area claim practically all the former "free territory" students? It is a good question.

Despite the hazards, an estimate of junior college enrollment as well as enrollment projections at all other levels, was made in January 1960 for the school year 1960-61. At the higher level, years of experience with junior college data and studies of trends may have justified the making of an "educated guess," for this is just about what was done. At each of the other levels the method used was as described earlier in this article. The results were as shown below in Table IV.

TABLE IV

Enrollment Projections for the School Year 1960-61

Level	*Estimate*	*Actual*	*Difference*	*Per Cent*
Elementary	15,037	15,169	132	0.9
Junior High School	7,317	7,385	68	0.9
Senior High School	6,498	6,396	- 102	- 1.6
Junior College	5,577	5,561	- 16	- 0.3
Total	34,429	34,511	82	0.2

Similar satisfactory results have been obtained in previous years when the same procedures were employed. It would appear that, in estimating elementary and secondary school enrollments by this relatively simple method, accuracy within about 1 per cent may be expected.

Any school system constantly loses and gains pupils. The method described above seems particularly appropriate to a community with a relatively stable population, such as Pasadena (census increase about 2 per cent a year; annual school population increase about 4.0 per cent). The survivorship ratios show for each school and for all schools at a given level the net result of losses and gains, in other words, the extent of net inmigration. In a school system that is rapidly gaining or losing students, say 10 per cent a year or greater, more elaborate methods of projecting enrollment would probably be needed. The "simple" method, perhaps with some modifications, could still be employed as a check on the other more complicated procedures.

The Conscious and the Unconscious in Research

(Continued from page 50)

of years and the "tank will fill up" again.

When the cat's away the mice will play. When conscious reflection on a problem is temporarily recessed, the subconscious mind keeps plugging away. Just as the hen is not consciously directing the formation of the egg inside her, so is the researcher not consciously directing the process of an idea's accreting in his subconscious mind, but, in each case, when the product is ready for delivery, it comes to the surface. A writer in the Old Testament would have described the process as *"an angel of the Lord appearing unto him in a vision, saying . . ."* But a scholar today would simply describe it as an idea accreting in the subconscious.

So what? The researcher, particularly when he is planning his procedure and writing his report, but at other stages as well, should take time; sleep over it; allow his subconscious time to operate. But, most of all, he should heed his subconscious, keep a pencil and note paper at hand constantly, and exercise the necessary self-discipline to record hot ideas when they present themselves.

Follow-up Study of College-Bound Graduates With An Analysis of High School Experience

WILLIAM GEORGIADES

During periods of rapid change, it is always more difficult to evaluate the educational experiences the school provides for its pupils. Recent changes in society and the general body of knowledge in all fields have been coupled in many high school districts in California. Often pressures of finance, housing, and personnel expansion have left little time or money to be devoted to an assessment of the quality of the educational product.

In order to fill this void partially, at least, and better ascertain the kind of job the Whittier Union High School District was doing with one segment of its pupils—its college-bound graduates, a follow-up study was conducted during two years, 1958-1960. This study was actually the product of many people who willingly gave of their time to make it possible.

Procedures and Sources of Data

In September 1958, a committee was appointed in the Whittier Union High School District to study and recommend procedures for a district-wide follow-up of college-bound graduates. The June 1959 graduating class was selected for follow-up purposes.

During the fall of 1959, all June graduates who had requested that their final transcripts be forwarded to colleges were sent a return-address post card which asked them if they were attending college and, if so, the name of the college. Of the 1,817 graduates, 991, or 55 per cent, had requested final transcripts, and 69 per cent of this group responded to the post card questionnaire. Ninety-four per cent of those responding were actually enrolled in college.

The post cards were classified into four categories, determined by the type of collegiate institution which the respondent was attending: junior

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college, private college or university in California, State college, and the University of California. This categorization accounted for 92 per cent of the responses. The remaining 8 per cent were attending out-of-state colleges or universities and vocational schools of business and nursing.

Interviews were planned during the winter and spring of 1960 on various campuses with a sample population from each of the four collegiate categories. On a sampling basis, approximately one of every three respondents attending private colleges and universities in California, State colleges, and the University of California was scheduled for an interview. Because of the large numbers involved, one of 2.3 respondents attending junior colleges was scheduled for an interview. Interviewing personnel found it difficult to locate graduates on junior college and State college campuses. Consequently, the actual interviews conducted consisted of 10 per cent of those responding to the post card questionnaire who were attending junior colleges; 15.4 per cent attending State colleges; 34 per cent attending private colleges and universities; and 36.5 per cent attending the University of California.

A college interview guide was developed. It consisted of one sheet to be filled in by the interviewer and one sheet which the graduate completed. These interviews constituted the basic source of data from which the findings were derived.

Delimitations

This study was limited to one segment of the graduating population of the Whittier Union High School District, those attending college. No attempt was made to study those in other categories.

The variations in admission requirements of collegiate institutions might be a factor influencing the type of students who enroll. Admission policies are possibly a strong influence in determining the adequacy of a student's preparation for college. For example, the typical junior college has few admission requirements, whereas some other institutions have very rigorous admission standards.

It is also reasonably obvious that students attending colleges offering specialized, technical curricula might find certain high school experiences, such as foreign language, to be of lesser value than those attending an institution with a strong liberal arts emphasis.

The nature of the sampling interviewed was another delimiting factor. As indicated earlier, it was difficult to locate graduates on junior college and State college campuses, and in some cases, impossible. Since the State University and private institutions expended considerable effort to arrange interviews, more interviews were conducted, proportionately, on private college and university campuses and at the University of California. Thus,

the sampling tends to be slanted in the direction of some of the major four-year colleges and universities throughout the State.

It was not financially feasible to interview out-of-state students. Consequently, the sampling is limited to students attending colleges and universities in California.

Of the total population attending some type of collegiate institution, such a small percentage attended business and nursing schools that they were omitted from the study.

Only those requesting that final transcripts be sent to a collegiate institution were contacted. It was assumed that colleges will normally not admit a student without a copy of his final high school transcript. The sampling was structured to interview one in three respondents. It was the District committee's opinion that this would be an adequate sampling for purposes of this study.

Findings

Approximately 51 per cent of the graduates of the Whittier Union High School District who attended college entered junior colleges. This figure varied from 36 per cent of the college-bound seniors at one high school to 63 per cent at another. Private universities and colleges attracted approximately 15 per cent of the college-bound graduates; State colleges, 14 per cent; the University of California on its many campuses, 12 per cent; and out-of-state colleges and universities, 7 per cent.

The percentage of high school graduates continuing their education was 51.3 per cent. This compared with the Los Angeles County average for 1957-58 of 51.9 per cent. A higher percentage of college-bound graduates from the Whittier area tend to enroll directly in four-year collegiate institutions than is true of the Los Angeles County average.

The drop-out rate during semester I varied from 16 per cent in junior colleges to no drop-outs in private colleges and universities. The figure was 12 per cent for the University of California campuses, and 3 per cent at State colleges.

Ninety per cent of the students interviewed believed that they had chosen the correct college. They appeared to be doing their best work academically in science, social studies, English, and math. Of those who answered the question, "Do you feel you were as well prepared by your high school as are the other college freshmen in your class?", 77 per cent said, "Yes." The opinion was expressed by many of the graduates that there should be more emphasis on composition and essays in high school, as well as good study habits. When asked, "What high school subject do you wish you had taken?", more science, math, and foreign language were mentioned most frequently.

There were considerable variations in the evaluation of high school

experiences among those attending differing types of collegiate institutions. As shown in Table I, junior college students rated their high school music experiences at "9," or of considerable value, whereas students attending the University of California gave music a rating of "6," which is slightly above midpoint on a ten-point rating scale. There was also considerable variation in the evaluation of home economic experiences.

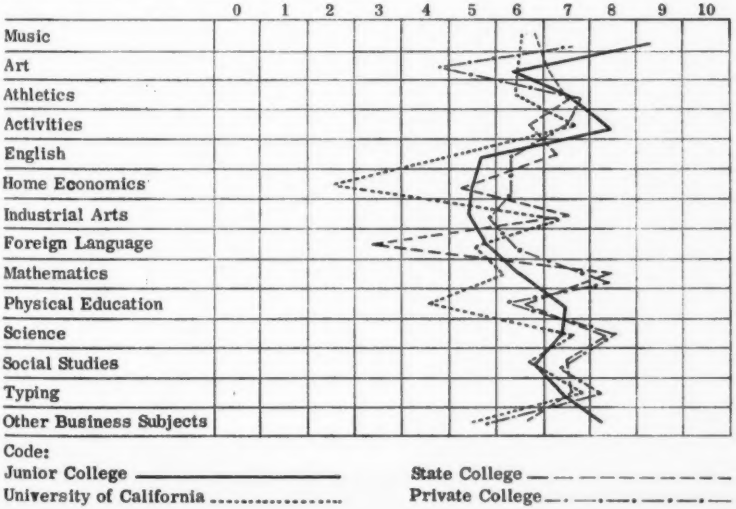
Foreign language was seen as of little value by graduates attending State colleges, but of considerably more value by those attending private colleges and universities. This variation could be the result of a greater emphasis on foreign language by private colleges and universities, as compared with the State college system.

Science, typing, activities, athletics, and social studies were consistently viewed as being of value by all four groups attending different types of collegiate institutions.

TABLE I

Group Average of Evaluations of High School Experiences by Graduates Attending Various Types of Collegiate Institutions

"O" Represents "No Value" While "10" Represents "Great Value."



Code:
Junior College ———————
University of California .....
State College — — — — — — — —
Private College —. —. —. —. —

TABLE IA

Evaluation of Their High School Training — by Percentages — by Graduates Attending Various Types of Collegiate Institutions

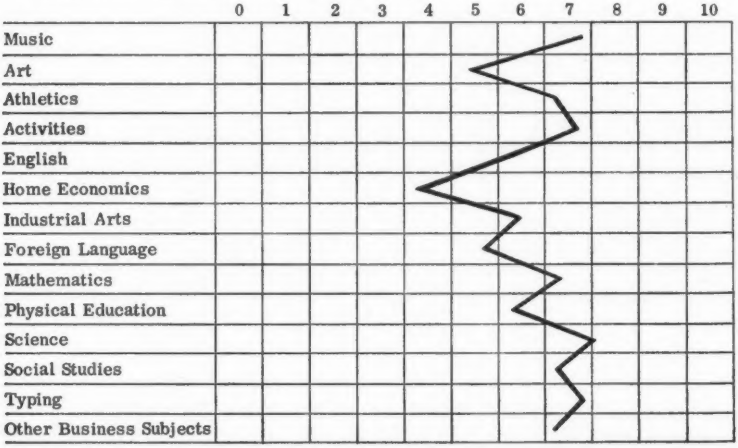
Training in:	*Percentage who considered training:*											
	Strong				*Adequate*				*Weak*			
	*JC**	*UC*	*SC*	*PC*	*JC*	*UC*	*SC*	*PC*	*JC*	*UC*	*SC*	*PC*
Note-Taking	24	19	11	11	43	41	22	57	33	40	67	32
How to Study	3	15	23	17	57	37	44	50	40	48	33	33
Public Speaking	10	19	0	30	57	52	22	44	33	29	78	26
Writing Term Papers	14	26	12	33	52	56	50	53	34	18	38	14
Taking Essay Exams	13	23	11	16	50	35	56	39	37	42	33	45
Library Use	27	26	44	30	63	63	44	50	10	11	12	20
Budgeting Your Time	0	7	12	11	67	59	56	41	33	34	33	48

*JC indicates Junior College; UC, University of California; SC, State College; PC, Private College.

TABLE II

Group Average of Evaluations of High School Experiences by All Graduates Interviewed Attending Colleges and Universities*

"O" Represents "No Value" While "10" Represents "Great Value."



*106 Interviews or 16 per cent of those responding who were attending some type of collegiate institution

As can be seen in Table II, the group average of evaluations of high school experiences by all graduates interviewed attending colleges and universities shows music, athletics, activities, mathematics, science, social studies, and typing as being the most valuable. Graduates apparently believed they were weakest in note-taking, how to study, public speaking, and budgeting of time.

TABLE IIA

Evaluation of Their High School Training — by Percentages — by All Graduates Interviewed

Training in:	*Percentage who considered training:*		
	Strong	*Adequate*	*Weak*
Note-Taking	17	45	38
How to Study	13	48	39
Public Speaking	13	48	39
Writing Term Papers	24	53	23
Taking Essay Exams	19	48	33
Library Use	29	57	14
Budgeting Your Time	6	56	38

Conclusions

The results as indicated in the findings above should be carefully reviewed by curriculum and guidance personnel for future planning. The kinds of guidance and curriculum experiences which appear to be most beneficial to the college-bound graduate should be considered. It also appears that there would be some gain in continuing with a longitudinal study of a particular graduating class to note such factors as changes in attitudes towards high school experiences, the actual percentage of graduates from college, and the number who enroll in graduate school.

The Effects of Leisure Time Activities On Scholastic Achievement

ROBERT L. HEMMERLING AND HOMER HURST

The youth of our country are living in an era of steadily increasing leisure. No longer are the majority of adolescents forced to work long hours at home and outside the home to contribute to the welfare of their families. Instead, they are being deluged with many possible leisure-time activities. Our young people must learn to judge and select wisely from these activities so that their newly found leisure can be used to improve the quality of this and subsequent civilizations. The future of our American culture may well partly depend upon how the youth of today spend their leisure hours and the effect which those activities have upon the development of their intellects. Herein lies the general area from which the problem of this study arises.

More specifically, the purposes of this study included the following: (1) to determine and describe the leisure-time activities of the sophomore students at La Habra, California, High School; and (2) to examine the relationships which may exist between the amount of time spent by a student in selected leisure-time activities, and his scholastic achievement.

Study Procedure

This study centered upon one group of 202 sophomore students at La Habra High School in the Fullerton, California, district. The investigation was delimited to a consideration of the following leisure-time activities which represent those pursuits judged to be of most interest and importance to the problem:

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Homer Hurst, chairman of the department of education at Whittier College for the past three years, has been with this institution since 1950. He was formerly a high school teacher, principal, superintendent of schools, and professor at Muskingum College in Ohio. Dr. Hurst is a graduate of Illinois State Normal University and earned his master's degree at the University of Illinois and the Ph.D. from George Peabody College.

1. television viewing
2. studying
3. working
4. listening to music
5. sports
6. reading
7. dating
8. church
9. motion picture viewing

The problem considered only the students' utilization of leisure time during the school months, since its influence upon academic achievement was the prime consideration. The data were collected by means of a questionnaire which was administered to all students enrolled in the Health Education classes. This class is required of all sophomores and therefore provided a representative sample of students for that age group of the high school. Final administration of the questionnaire was accomplished by the writer meeting with each class, discussing the general nature of the study with them, and remaining to answer any questions which arose while they were completing the questionnaire. In order to alleviate any misgivings the students might have had about answering the questions, they were asked not to sign their names. The questionnaires were serially numbered so that the name of each student could later be matched with his questionnaire, and thus the relationship between his leisure-time activities and his academic achievement could be examined. From individual cumulative records, the semester grades earned by the students in academic subjects in high school were converted into grade-point averages which were, in turn, used in computing the correlation coefficients found in Table II.

Two-variable linear correlation procedures were used to examine relationships which might exist between specific activities and grade-point averages. The coefficients of correlation (r) were calculated by the Pearson product-moment method from grouped data. The significance of each coefficient of correlation computed from this study was tested by two methods. Each r was tested against the null hypothesis, i.e., that its true value was in fact zero. Also, the standard error (SE) of each r was computed to test the dependability of the computed values of r.

Findings and Conclusions

Table I presents a summary of the amount of time spent by the students in each of the selected activity areas, together with comments concerning over-all trends noted, and Table II presents a summary of the computed coefficients of correlation and their statistical interpretation.

Following are the conclusions drawn from the analysis of the data gathered in each selected activity area:

1. **Television:** The student devotes almost as much time watching television on school nights as he does studying. More over-all time is spent on television than on any other leisure activity. A significantly large number

TABLE I

Use of Leisure Time by High School Sophomore Students

Activity		*Average Amount of Time Spent*		*Preferred Form of That Activity*		
		Boys	*Girls*		*Boys*	*Girls*
Television Viewing	School Night:	2.3 hrs.	1.6 hrs.	Favorite types:	Detective	Detective
	Weekend "	3.3 hrs.	4.1 hrs.		Comedy	Musical
Studying	School Night:	2.0 hrs.	2.9 hrs.	Favorite Subjects:	Mathematics Science	English Foreign Language
Working	At Home	0.9 hrs. daily	1.3 hrs. daily	Part-Time Jobs:	Mowing lawns Odd jobs	Baby sitting Waitress
	Outside Home	4.9 hrs. weekly	4.0 hrs. weekly			
Listening to Music		2.9 hrs. daily	3.2 hrs. daily	Favorite type music:	Rock and Roll Popular ballads	Rock and Roll Popular ballads
Sports		5.1 hrs. weekly	2.1 hrs. weekly	Participation: Spectator:	Football Football	Softball Football
Reading		33 min. daily	25 min. daily	Favorite type book:	Adventure Science Fiction	Romance Adventure
Dating		2.2 dates per month	3.3 dates per month	Favorite date activity:	Movies, dances, parties	
Church		1.1 hrs. weekly	2.1 hrs. weekly	Church membership:	62 per cent	80 per cent
Movies		2.3 times monthly	2.3 times monthly	Favorite type movie:	War Comedy	Musicals Comedy

TABLE II

Summary of Simple Correlations Computed and Their Interpretations

Grade Point Averages versus:	*Size of Sample*	*Calculated r*	*Interpretation*
Television	187	−0.14	barely significant at .05 level not significant at .01 level
Study	185	+0.48	very significant
Work	187	−0.24	significant at .05 level barely significant at .01 level
Music	191	−0.29	significant at .01 level
Sports	185	+0.10	not significant
Reading	189	−0.05	not significant
Dating	185	−0.02	not significant
Church	182	+0.08	not significant
Movies	188	−0.22	significant at .05 level barely significant at .01 level

of students appear to be influenced personally by television viewing. Only a very slight relationship exists between this activity and school grades.

2. **Studying:** The amount of time being devoted to studying corresponds closely with that expected by the administration of La Habra High School, i.e., about 2.5 hours each night. Students experiencing difficulty with school work are not seeking the best trained help, since parents provide the most outside help, and teachers the least. Only a small percentage of students always keep their study area free of self-imposed distractions. However, lack of a sufficiently quiet study area at home was the major comment relating to home study conditions. There was found to be very substantial evidence that a greater amount of study time tends to be accompanied by higher grades.

3. **Work:** The amount of leisure time devoted to working around the home and on part-time jobs is reasonable and not considered excessive. Boys seem to hold part-time jobs because of long-range goals, such as a car or college, while girls work primarily to obtain spending money for their more immediate desires. It was concluded that outside work, particularly in excessive amounts, tends to be related to lower academic achievement.

4. **Music:** The study indicated that, while music does occupy a sizable portion of the students' leisure time, they do not consider it to be of great importance in their lives. While "rock and roll" music is still very popular, its appeal is neither unanimous nor perhaps as ubiquitous as is popularly believed. There exists a slight, but significant, tendency for low grades to

be accompanied by large amounts of time devoted to musical listening.

5. **Sports:** The results of the study indicated that the amount of time spent by the student in sports activities, outside of Physical Education classes, bears no relationship to scholastic achievement at this age level.

6. **Reading:** The amount of leisure-time reading done by the students was found to be quite limited. Also, the quality of the reported reading material proved to be questionable in some cases, implying a need to encourage the multiplication of interest areas and the inclusion of more thoughtful materials. The amount of leisure-time reading is not related to academic success.

7. **Dating:** A majority of the sophomores have begun dating; the girls more frequently. Most sophomore girls date junior-class boys as a rule, while the boys generally date girls at their own age level. Most dates end at approximately 12:15 a.m. The results would indicate that, while "going steady" is not common (14 per cent) at this age, there is a substantial minority who are not averse to this practice. No relationship was observed between dating frequency and scholastic achievement.

8. **Church:** Approximately 50 per cent of the boys and 20 per cent of the girls reported having little or no contact with any form of religious activity. It was evident that girls at this age level are considerably more active in religious endeavor than boys. The largest number of boys attend church services because "they think they should," while most girls attend "because they want to." There appeared to be no significant relationship between the amount of leisure time devoted to religious activities and school grades.

9. **Movies:** Sophomore students attend movies often, and a considerable portion of the motivation for doing so lies in the social aspects of the occasion or their state of boredom. It seems that movies have little personal influence upon the teenager. A significant, although low, relationship indicated that an increase in movie attendance tends to be accompanied by lower grades.

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An Exploratory Study of the Relationship Between Grades and a Pictorial Interest Test

HAROLD GEIST

The relationship between measures of academic achievement and interests is controversial, although there have been many studies in this area which used grades as the criterion of academic achievement. Often the contradictory findings are explained on the basis of the unreliability of the criteria and/or the variability in grading from one institution to another, even within the same state and in some instances within the same county or district. The correlation of grades with various scales of the Kuder and Strong has been reported in more than ten studies with each instrument. Generally, the results indicate that the correlations are low, rarely reaching above .50. The purpose of this study was to attempt to assess the Geist Picture Interest Inventory (GPII) in terms of predictive value of educational success in high school. There is the possibility that the motivational factor measured by the GPII may in some instances be able to predict scholastic success in certain subjects and thus supplement the results of the usual scholastic aptitude tests employed in the various junior and senior high schools.

The study was actually divided into three parts. First, correlations were obtained between each of the scales of the GPII and grades in comparable subjects. Then, the predictability of each scale in terms of comparable grades was ascertained. Finally, an item analysis of responses was made to note which items were selected by "good" students and which were chosen by "poor" students. The latter procedure was used to get a pool of items

Harold Geist is principal investigator of a Picture Interest Research Project currently being conducted at the California School for the Deaf under a grant awarded by the Office of Vocational Rehabilitation, U. S. Department of Health, Education and Welfare, for the purpose of constructing a picture interest test for the deaf. Dr. Geist obtained his doctor of philosophy degree from Stanford University in 1951.

This is the second of a series of validity studies on the GPII. The author gratefully acknowledges the assistance of the school districts for permitting the testing of students and the furnishing of grades in specified school subjects, the work of John Morledge, graduate student in psychology, University of California, for gathering the data and assisting in the statistical computations, and the cooperation of the Computer Center, Radiation Laboratory at the University of California at Berkeley.

for each subject which might eventually indicate the success of a student in a given subject or a cluster of subjects.

The GPII was administered to 160 male students in grades 11 and 12 in the Albany and Pittsburg (California) School Districts. Grades in comparable school subjects[1] were obtained for each of the ten scales from school records. The following scales were used: (1) persuasive, (2) clerical, (3) mechanical, (4) musical, (5) scientific, (6) outdoor, (7) literary, (8) computational, (9) artistic, and (10) social service. Letter grades in each subject were arbitrarily assigned numerical ratings, and the grades then were correlated with the scale score for each respective scale.

Results of Study

The results seem to indicate that at both grade levels there was a moderate correlation between the musical scale of the GPII and grades in music and music appreciation, especially in the 12th grade. The next highest correlation was between the artistic scale and the art grades. In descending order were the correlations between clerical and typing, stenography, bookkeeping, and business training grades; computational and mathematics grades; literary and English grades; social service and social studies grades; scientific and natural or biological science grades; outdoor and gym grades; persuasive and public speaking grades; and mechanical and shop grades. Probably the motivational factor in the musical and artistic scales was related to academic success in music and art respectively; however, there was a negative relationship between the mechanical scale and academic success in auto shop, mechanical drawing, or shop.

The second part of this study was to determine the predictability of

[1]The following subject criteria were used for each of the indicated scales: (The first subject was the preferred one and those following in order of preference.)

Scale	Subject(s)
1. persuasive	public speaking
2. clerical	typing, stenography, bookkeeping, business training
3. mechanical	auto shop, woodshop, body and fender, machine shop, mechanical drawing, printing
4. musical	music, glee club, orchestra, band
5. scientific	chemistry, general science, physics, biology
6. outdoor	physical education, gym
7. literary	English, journalism
8. computational	last math course taken
9. artistic	art, arts and crafts
10. social service	social studies, problems in democracy

The rationale behind choosing these subjects was based on an inspection of the items in each of the scales. The author felt that the subject matter curriculum in each of the schools closely resembled the items in each scale. Because drama or dramatic art was not taught in the schools as a school subject, the dramatic scale was omitted.

each scale for determining academic success in the aforementioned fields or subjects. This was done as follows: All grades of students who scored one standard deviation plus the mean and the mean minus one standard deviation were obtained.[2] The mean grades of the high scores and the mean grades of the low scores were computed and the difference between the means was determined. When this difference is divided by the standard deviation of the difference, a critical ratio is obtained. Critical ratios above 3 sometimes may be considered predictive for comparable school subjects. Levels of confidence of predictability were obtained, and it was found that the musical, outdoor, computational, and social service scales were predictive at the .01 confidence level for the subjects indicated, showing selective power for these scales. There was less selective power for the artistic, literary, clerical, and scientific scales, and practically no selective power for the persuasive and mechanical scales for the subject indicated. This would seem to point out that this instrument might be used as an adjunct to other kinds of tests, primarily aptitude tests, in predicting school achievement in music, physical education, mathematics, and social studies. The whole problem of motivation in these subjects is an unexplored one, and the GPII may assist in this endeavor.

An item analysis of the various items in each scale was made to find out what percentage of good students in a given subject chose items on the comparable scale. A and B students were "lumped together" to get a pool of "good" students in a given subject; C students were taken as "average" students; and D and F students were "lumped together" as "poor" students.

The item analysis was carried out in two ways. The percentage of "good," "average," and "poor" students in each subject who chose each picture in the respective scale was calculated, and the medians of the "particularly applicable" pictures in the respective scales were also computed. "Particularly applicable" pictures were those which in the author's judgment most nearly conformed to the particular subject. In some scales, e.g. musical, all the pictures represented the school subject. However, on the clerical scale only two pictures were directly connected with the particular scale (typist, filing cabinet). Other pictures in this scale, for example, were tangential to typing, stenography, bookkeeping and business training but not directly related to it; for example, mailman and shoe salesman have clerical duties but are not directly related to the aforementioned subjects.

The results seemed to indicate that scale 2 (clerical) had some discriminatory power, both as a whole and for the "particulary applicable" pictures, since the percentage of students tended to decrease with grade attainment.

[2]This will include approximately 16 per cent of the cases on each end of the normal curve, i.e. the upper and lower 16 per cent of the total grades. For example, all the public speaking grades of students who scored 8 and above ($N = 10$) and 4 and below ($N = 12$) on scale 1 were obtained. Eight was one standard deviation above the mean and 4 one standard deviation below the mean.

TABLE I — Correlations*

Scale	1 public speaking	2 typing etc.	3 auto shop etc.	4 music etc.	5 chemistry etc.	6 physical education	7 English	8 math	9 art	10 social studies
	subject									
1. persuasive	.06 −.14 .22									
2. clerical	.19 .36 −.12									
3. mechanical	−.14 −.28 .06									
4. musical	.30 .25 .42									
5. scientific	.11 .11 .10									
6. outdoor	.09 .13 .07									
7. literary	.13 .17 .07									
8. computational	.17 .17 .17									
9. artistic	.21 .26 .15									
10. social service	.12 .15 .05									

* Number in upper right hand corner of box is 11th grade correlation coefficient, one in the middle is 12th grade, and one on left is combined 11th and 12th grades.

TABLE II

Example of Item Analysis on Computational Scale, Number 8

Comparable School Subject: mathematics				
		Per Cent Choosing		
Picture (= item & choice)	*Identification of Picture*	*AB*	*C*	*DF*
3–2	math teacher*	29	30	16
3–3	business executive	56	50	68
5–3	man on a machine	73	74	67
6–3	surveyor	62	56	59
9–3	math*	56	40	29
19–1	draftsman	76	46	21
23–2	graduation diploma	62	56	48
24–3	business	42	40	37
25–2	astronomer	58	56	52
29–3	bank teller	53	60	44
32–2	census taker	11	30	29
33–2	statistical chart	47	32	35
34–3	business man	73	54	52
35–3	meteorology	33	42	33
36–3	student	51	44	44
37–2	compass - square*	62	46	52
39–2	statistician	78	66	60
40–1	computing machine*	49	54	46
41–2	atomic physicist*	60	72	62
42–1	architecture	91	86	79
44–2	calculator*	51	38	37
	median	56	50	37
	N	45	50	63
*Median of pictures particularly applicable		56	46	46

Likewise, in scale 4 (musical) there was a consistent relationship with grade. Scales 6, 7, and 8 seemed to indicate a diminution in selectivity as we go down the grade attainment level, especially with the "particularly applicable" items. The other scales seemed to be fairly constant in selectivity with respect to grade attainment.

Summary

This study attempted to compare academic achievement as evidenced by grades and scores on various scales of the GPII. There was a positive relationship between grades in given subjects and scores on comparable scales of the *Inventory* with the exception of the mechanical scale. The scales were shown to have selective power for given school subjects (with the exception of the mechanical and persuasive scales) and suggest that the instrument might be used as a supplement to other kinds of objective tests,

particularly aptitude and achievement tests, in predicting success in given subjects. Finally, five of the scales seem to have some selectivity, using as a criterion the percentage of students choosing at various grade attainment levels in given subjects. More research is indicated in this area, particularly with respect to using particular items to predict success in given subjects.

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